

Fabrication of Graphene Oxide Nanofibrous Thin Film using Electrojet Spraying

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Abstract

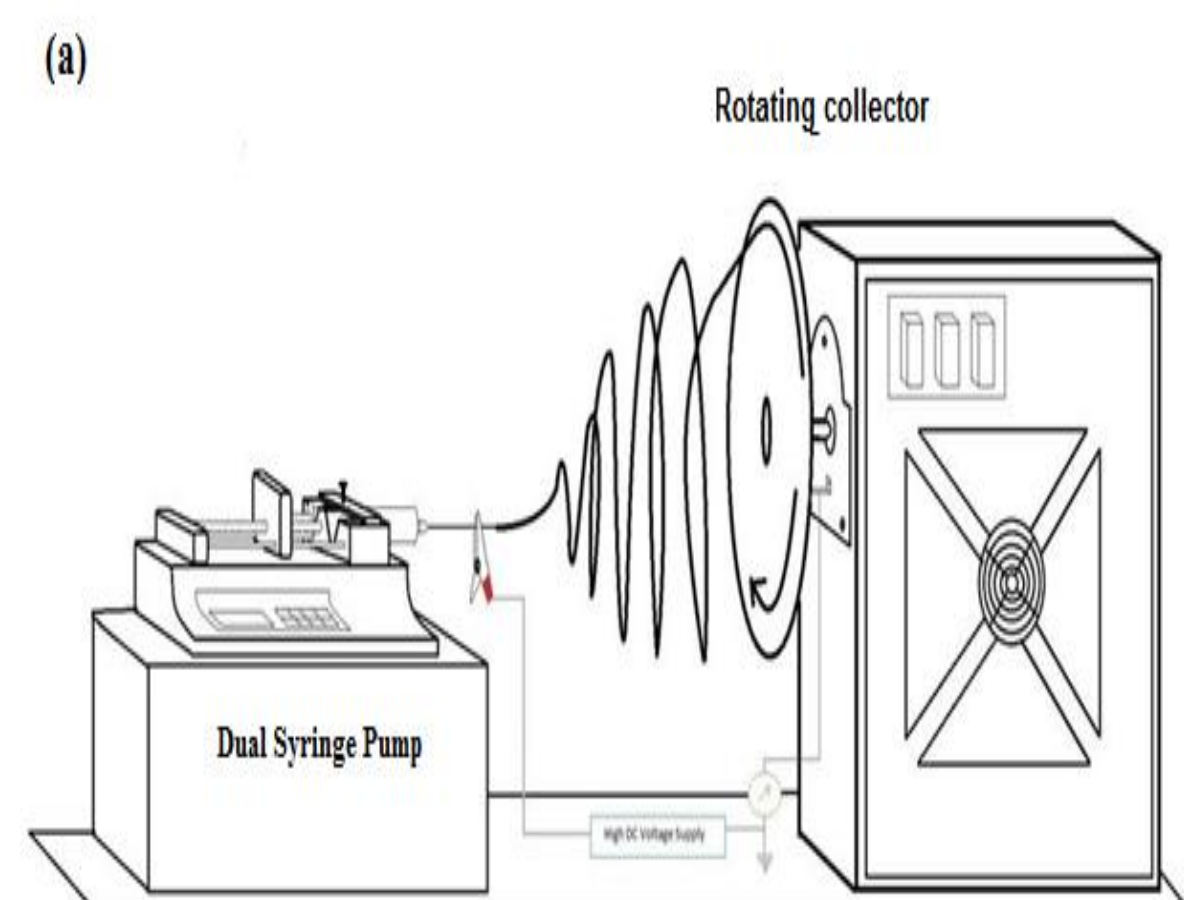
Graphene oxide (GO) is a promising material with excellent properties. The GO has an aromatic lattice sheets of graphene with multi oxygen functional groups, such as ketone, carboxyl, and carbonyl groups. The addition of these groups is resulting from an oxidation treatment of the graphene. Go has the ability to exfoliate in many solvents and disperse in the water. Hummers method is an improved way to synthesize the GO because no toxic gas forms in yield. It is a reversible material, so the graphite can be restored from the GO within electrochemical reduction. The advantage of the GO gives it the chance to take a part of various applications. The electrical and the mechanical are the main fields for the GO. Many groups made films and nanofibers of GO by using a combination of GO with other substances like, solvents or polymers to enhance the viscosity of the GO¹. The aim of this work is to form the GO nanofibers from it owns film, which means self-assembly of the GO nanofibers. Furthermore, the GO which been used is pure. Two different techniques have been followed to overcome the viscosity issue of the GO. Electrospinning for the GO solution preformed as the first method. In this method the potential difference between the syringe and the collector causing an electric filed to draw the solution and form the fibers. The second method was vacuum filtration where the vacuum is used to absorb all the liquids and leave the GO over the filter to get fibers. These GO thin films can be used in plethora or applications such as energy storage, water and like solution filtration, oil and water separations and many more.

Methods

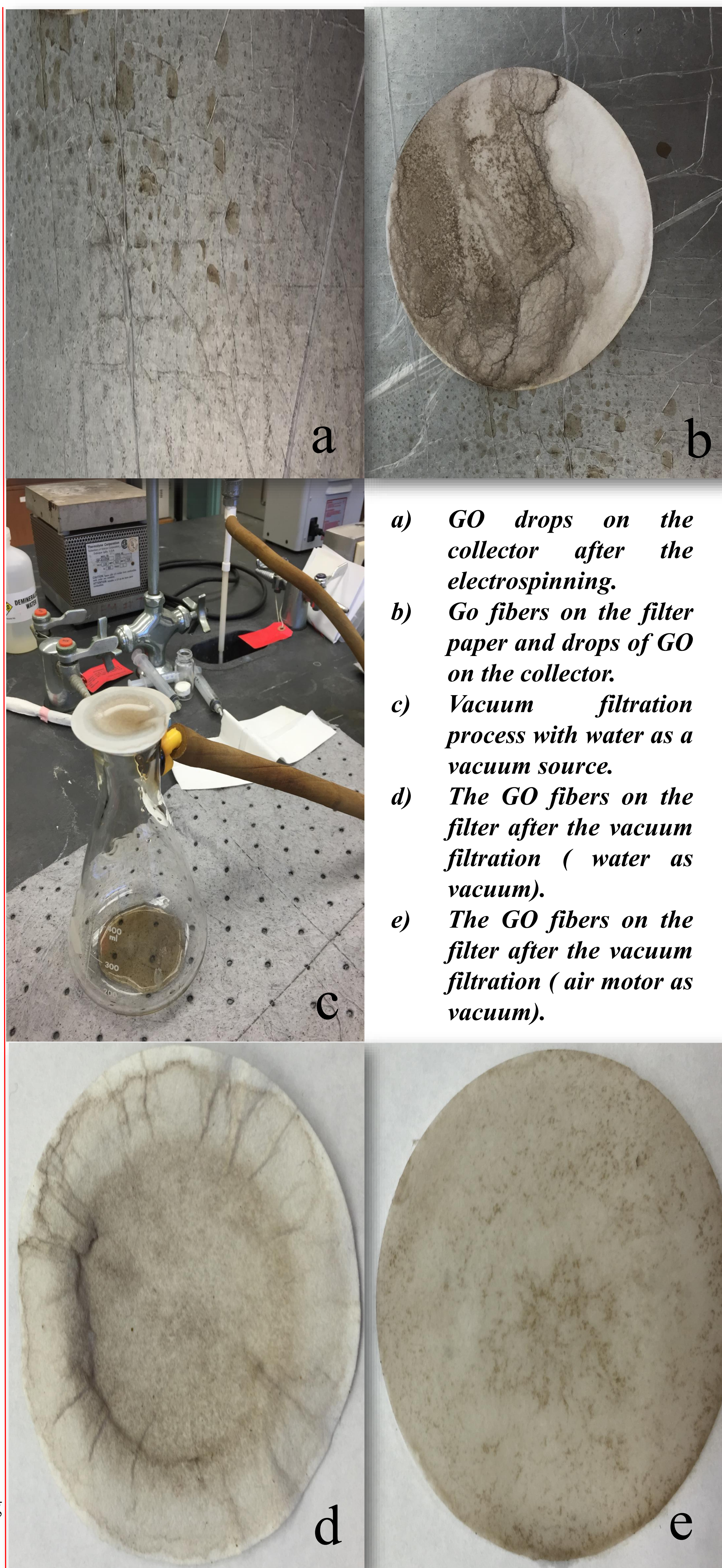
The (GO) is commercial and it has been used in the laboratory to make the GO solution. This solution is water based once. In addition, the sonication was important step before the experiment to ensure that all the GO particles in proper place. Electrospinning is a method to pull out a fiber of certain solution via the electrical field. Moreover, Vacuum filtration is a method that depends on the air force to pull all the water or the solvent out of the sample.

A. Electrospinning Method:

- 12ml of GO solution was loaded in needle syringe of 3ml volume (3 times of loading).
- The spinning of the sample run under 17KV potential difference and 15cm distance between the needle's tip and the collector.
- After that another condition has been done.
- 12ml volume of solution with in 12cm distance and addition of filter paper.
- The sample was completely dry at the room temperature. The paper used in this point to soak up all the water.



a) Schematic figure of the electrospinning device. (Aphale et al 2015, p.19)²



B. Vacuum Filtration Method:

- In this part two vacuum sources have been used, air motor and water tap. The process remained the same with both of them.
- The filter paper applied over the filter flask then 12ml of GO solution pumped gradually from the needle to the filter paper in the room temperature.(Fig.c).
- The pumping was in center of the filter paper. The process took several hours until all the solution used. The filter dried completely at the room temperature.

Result

In the first part of the electrospinning only drops formed over the collector (Fig.a). However, after the addition of the filter paper the fibers formed over the filter (Fig.b). The fibers were cleared to see. In the second method, the fibers were made with in both vacuum sources. In (Fig.e) the fibers more clear than (fig.d) not because of process but the water affected on the filter it self. The main issue was removing these fibers from the filter paper.

Conclusion

The GO nanofibers is a multi-benefits material in many fields. The outstanding properties of the GO has been proven in many reports. In this poster two methods preformed to form pure GO nanofibers. The self-assembly was the main approach in this work. The purpose of using different methods is to solve the viscosity issue without adding any material to the GO. The net result were fibers ,but it wasn't a peeled one. the upcoming work will concentrate on producing self-consistent films of GO nanofibers.

Reference

1. Daniela C. Marcano..et al, Improved Synthesis of Graphene Oxide, *American Chemical Society*, 2010, 4:4806-4814.
2. Ashish N. Aphale..et al,Fabrication and Experimental Analysis of Axially Oriented Nanofibers, *Journal of Nanoscience and Nanotechnology*, 2015 (in press).